Triple knockout of frdC gltA and pta genes enhanced PHA production in Escherichia coli

ABSTRACT

Polyhydroxyalkanoate (PHA) is a linear polyester produced through the fermentation of sugar or lipid. Biosynthesis of PHA comprises three enzymes known as acetyl-CoA acetyltransferase (phaA), acetoacetyl-CoA reductase (phaB) and PHA synthase (phaC). Comamonas sp. is one of the strains commonly used for PHA production. In order to develop higher PHA production from bacterial respond strategy, PHA biosynthesis operon of Comamonas sp. EB172 was introduced into Escherichia coli BW25113 through a pGEM-T vector. E. coli was chosen due to the complete genome information available and the absence of depolymerisation gene, phaZ. In this study, the deletion of several single genes, which are frdC, gltA, and pta, was found to be associated with PHA metabolism activity in E. coli BW25113. P1 transduction was performed to construct multiple genes knockout. The engineered strain, E. coli BW25113 frdCgltApta::kan/pGEM'-phaCABCo, yielded the highest PHA production at 64 wt.% with 1.4 fold higher than that of control strain of E. coli BW25113/pGEM'-phaCABCo. This strain is potential for industrial application for higher PHA production from E. coli.

Keyword: Escherichia coli; FrdC; GltA; P1 transduction; Polyhydroxyalkanoates; Pta